Original Research Article

Spiral CT evaluation for inflammatory and neoplastic lesions of paranasal sinuses

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Abstract

Background: In the modern era otorhinolaryngologist consider that CT is of paramount important in evaluating the paranasal sinuses before planning for FESS (functional endoscopic sinus surgery) such that it helps in determining the extent of sinus involvement and also to see for any anatomical variations such as septal deviation, spur formation, concho bullosa etc., as these conditions would complicate FESS procedure. **Aim:** To assess the accuracy of CT in detecting inflammatory conditions and tumors in paranasal sinuses. **Methodology:** A cross-sectional study was conducted for a period of 6 months in the department of radiology of Vinayaka Missions Kirupananda Variyar Medical College and Hospital. Patients with symptoms of headache, nasal obstruction, nasal discharge or epistaxis and were refereed from ENT department were subjected to CT and later surgery was conducted and the specimen was sent for histopathological examination. A total of 104 patients were taken as our study subjects. A semi-structured questionnaire was prepared to collect the details regarding the socio-demographic history and the clinical history of the patients. All patients were subjected to CT using Siemens 16 slice CT scanner. **Results:** The validity of CT imaging in comparison with HPE for detecting PNS pathologies shows that the sensitivity and specificity along with the negative predictive value was very high for detecting polyps and neoplasm compared to detection of sinusitis. The sensitivity was nearly 100% for CT in detecting AC polyp and it was 98.5% in detection of neoplasm of both benign and malignant type and for the detection of sinusitis it is 95.8%. **Conclusion:** CT imaging can be considered as the best non-invasive modality of investigative choice for evaluating osteomeatal complex anatomy, variations and for assessing bony changes in various sinonasal diseases.

Key Words: Sinonasal pathologies, CT imaging, histopathological examination.

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INTRODUCTION

Paranasal sinuses diseases is one of the most common pathological condition reported in the ENT department with a prevalence of 20%. Once X-rays was the only diagnostic tool available to screen the paranasal sinuses but now better imaging modalities like computed tomography were introduced to assess the paranasal pathologies.[1] The unique ability of CT is that it is able to image both the soft tissues and the bones and such a way it detects the abnormalities at both the nasal passage and the sinuses and so it was able to detect the sinonasal diseases. The commonest sinonasal pathology usually reported is either an inflammatory condition in the form of sinusitis or a neoplasm which is usually benign and sometimes malignant.[2,3] Today, otorhinolaryngologist consider that CT is of paramount important in evaluating the paranasal sinuses before planning for FESS (functional endoscopic sinus surgery) such that it helps in determining the extent of sinus involvement and also to see for any anatomical variations such as septal deviation, spur formation, concho bullosa etc., as these conditions would complicate FESS procedure.[4] CT is found to be

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much superior to MRI in visualizing the paranasal sinuses and it is considered as the gold standard test for diagnosing PNS pathologies.[5,6] The multislice spiral CT gets high quality multiplanar images both in coronal and saggital planes which help in imaging the space occupying lesions and the microanatomic locales such as the osteomeatal complex, which is a small area located between the middle turbinate and the lateral nasal wall in the middle meatus which serves as a draining area for anterior ethmoid, maxillary and frontal sinus, as meticulous screening of this area is very much warranted in cases of chronic sinusitis before the patient is taken up for FESS.[7,8] After the introduction of CT in 1960's many studies had been conducted in evaluating the role of CT in pathologies of paranasal sinuses but most of the studies have been done in western countries and very few Indian studies were reported and so in this context the present study was undertaken to assess and evaluate the accuracy of CT in the detection of inflammatory and neoplasm type of pathologies in paranasal sinuses.

METHODOLOGY

A cross-sectional study was conducted for a period of 6 months in the department of radiology of Vinayaka Missions Kirupananda Variyar Medical College and Hospital. The study was started after getting the approval from the institutional ethical committee and the informed consent was obtained from all the study subjects involved in the study. Patients with symptoms of headache, nasal obstruction, nasal discharge or epistaxis and were refereed from ENT department were subjected to CT and later surgery was conducted and the specimen was sent for histopathological examination. Patients with previous history of sinus surgeries, pregnant women, traumatic history of PNS and congenital anomalies were excluded from the study. Based on our inclusion and exclusion criteria a total of 104 patients were taken as our study subjects. A semi-structured questionnaire was prepared to collect the details regarding the socio-demographic history and the clinical history of the patients. All patients were subjected to CT using Siemens 16 slice CT scanner. Patients were advised for 4 hours fast prior to CT examination. Contrast studies were performed if indicated by injecting 60 – 76% of urograffin calculated at a dose of 300 mg/kg weight as a single bolus injection. Both axial and coronal images were acquired. The sinuses were evaluated for the following parameters: mucosal thickening, wall of sinus, fluid level, soft tissue extension, hyperdensities and masses, blockage of osteomeatal complex, and pattern of bony involvement. The results were recorded and expressed as sinus distribution, side of involvement, frequency of deviated nasal septum (DNS), concha bullosa, frequency of ostemeatal unit involvement, and provisional CT diagnosis. All the data were entered and analysed using SPSS version 22. Mean and standard deviation was calculated for all the parametric variables and percentage was derived for frequency variables. The validity of CT was tested by comparing it with the HPE reports by calculating the sensitivity, specificity, positive predictive value and negative predictive value.

RESULTS

The age and gender distribution of our study subjects shows that males were comparatively more in number than the females and majority of them were in age group between 40 and 50 years with a mean age of 42.9 years (table 1). The most commonly involved sinus causing sinusitis among the study subjects was maxillary sinus followed by ethmoidal and frontal sinus and most of the study subjects had more than one sinus involvement in having sinusitis and it is mostly maxillary and ethmoidal sinus (table 2). In our study we used Glicklich method for grading the sinusitis and in that grade II and grade III type was found to be more common which shows bilateral sinusitis is more common than the unilateral or pansinusitis (table 3). In our study sinusitis is the most common pathology identified in the paranasal sinuses which is followed by polyps and neoplasm and among polyps it was either inflammatory or antrochoanal polyp and among neoplasms it was benign neoplasm which is more common than the malignant, the common benign neoplasms which were reported are dentigerous cyst, capillary hemangioma and meningioma and among malignant neoplasm it was maxillary and ethmoid sinus carcinoma which was reported in our study subjects. A comparison of detection of paranasal pathologies between CT and histopathological examination shows that the detection rate of the PNS pathologies was almost similar between CT and HPE reports (table 4). The validity of CT imaging in comparison with HPE for detecting PNS pathologies shows that the sensitivity and specificity along with the negative predictive value was very high for detecting polyps and neoplasm compared to detection of sinusitis. The sensitivity was nearly 100% for CT in detecting AC polyp and it was 98.5% in detection of neoplasm of both benign and malignant type and for the detection of sinusitis it is 95.8% and so it can be very well quoted that CT imaging is a very useful and validated tool in comparison with HPE in detecting the pathologies of paranasal sinuses (table 5).

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Table 1: Age and gender wise distribution of the study subjects

Age group	Male	Female	Total
<20	5 (7.8%)	3 (7.5%)	8 (7.6%)
20 – 30	8 (12.5%)	4 (10%)	12 (11.5%)
31 – 40	17 (26.5%)	13 (32.5%)	30 (28.8%)
41 – 50	21 (32.8%)	14 (35%)	35 (33.6%)
51 – 60	9 (14%)	5 (12.5%)	14 (13.4%)
>60	4 (6.2%)	1 (2.5%)	5 (4.8%)
Total	64 (100%)	40 (100%)	104 (100%)
Mean ± SD	43.6 ± 8.2	41.8 ± 7.6	42.9 ± 7.4

Table 2: Distribution of the study subjects based on the sinuses involved

Sinuses involved	Frequency	Percentage
Maxillary	76	73%
Ethmoidal	51	49%
Frontal	36	34.6%
Sphenoidal	31	29.8%

Table 3: Grading of sinusitis by Glicklich method

Grading of sinusitis	Frequency	Percentage
Grade I (Unilateral sinusitis disease)	5	4.8%
Grade II (Bilateral disease limited to ethmoid and maxillary sinus)	54	51.9%
Grade III (Bilateral disease limited to sphenoid or frontal sinus)	32	30.7%
Grade IV (pansinusitis)	13	12.5%
Total	104	100%

Table 4: Comparison of the findings made between CT and histopathological examination

Diagnosis	CT	HPE
Non-specific inflammation (Sinusitis)	53 (50.9%)	58 (55.7%)
Inflammatory polyp	25 (24%)	23 (22.1%)
Antrochoanal polyp	10 (9.6%)	9 (8.6%)
Neoplasm	16 (15.3%)	14 (13.4%)
Total	104 (100%)	104 (100%)

DISCUSSION

After the invention of CT it has become the best non-invasive diagnostic investigation for finding out the pathologies in paranasal sinuses and the nasal cavity particularly in patients with persistent sinus disease. So to assess the validity of CT in diagnosing paranasal pathologies the current study was done comparing the results obtained between CT and the histopathological examination, which is considered as the gold standard investigation tool for assessing sinonasal pathologies. In the present study the most common age group had sinonasal pathologies were in 3rd and 4th decades and males were more commonly affected than the females with a male: female ratio of 1.6: 1 and almost most of the studies done earlier had a similar type of age and gender pattern. Among the various pathologies reported in the present study sinusitis is the most common pathology reported and in that maxillary sinusitis followed by ethmoidal sinusitis were the commonest and the results were almost in par with the studies done by Kushwah *et al*., Chaitanya *et al*, Zinreich, Bolger and Maru and Gupta and Sarabpreet Singh Kanwar *et al*.[9-14] In the current study majority of the patients had bilateral sinusitis rather than unilateral sinus involvement and the studies done by Kushwah *et al*., Dua *et al*. and Yousem had also mentioned the similar finding.[9,15,16] In our study the most common pattern involvement was sinonasal polyposis pattern followed by osteomeatal unit pattern and the least common was spheno-ethmoidal and infundibular pattern and it very well correlates with the study done by Chaitanya *et al*, Kushwah *et al* and Sarabpreet Singh Kanwar *et al*.[9,10,14] Anatomical variations such as deviated nasal septum and concha bullosa was seen in 30% and 19% in our study and a similar type of incidence was seen in the studies done by Asruddin *et al*, Maru and Gupta, Ahmed *et al* and Chakraborty *et al*.[13,17-19] As quoted in the previous studies most of the sinusitis was either grade II or grade III types which are of bilateral type of involvement rather than grade IV or grade I. The most common pathology of paranasal sinuses in our study which was detected by CT imaging was sinusitis followed by polyp and neoplasm and among neoplasm it was benign which was more common than malignant and the two types of malignant carcinoma reported in our study was maxillary and ethmoid sinus carcinoma and the benign lesions which were identified are capillary hemangioma, fibroma and dentigerous cyst. A study done by Mohammed A Gomaa *et al* among the Assam population had shown that the most common benign lesion was nasal angiofibroma and the most common malignant lesion was maxillary sinus carcinoma and a similar type of result was also shown by Salami *et al* and Chow *et al*.[20-22] Our findings further reflects that the detection of pathologic lesions through CT imaging was similar to that of the HPE diagnosis and it was further validated by measuring the sensitivity, specificity, positive and negative predictive value. In the present study, a good correlation was noted in cases of chronic sinusitis, polyps, antrochoanal polyps and neoplasms, as evidenced by high sensitivity and specificity values in cases of chronic sinusitis (95.8% and 96.2%), polyp (98.8% and 97.5%), antrochoanal polyps (99.7% and 98.4%), and neoplasm (98.5% and 97.8%), respectively. However, poor correlation was noted in cases of fungal sinusitis which was supported by the low sensitivity of 66.6%. Almost similar results were observed for positive and negative predictive values which were calculated for all type of diagnosis. Kushwah *et al*, Zenreich *et al*, Chaitanya *et al*, Rashmi Kandukuri and Sarabpreet Singh Kanwar *et al* had also showed a similar type of validity

results and in these studies they showed the sensitivity and specificity in diagnosing fungal sinusitis was 70 – 75%, whereas in our study we did not studied the fungal sinusitis instead we had taken it as inflammatory sinusitis as a whole.[9-11,14,23] Thus, CT plays an important role in diagnosing and also in adding important findings for the better management of the patients with sinonasal diseases.

CONCLUSION

This study proves that the role of CT in diagnosing sinonasal pathologies is significant with a very high validity when compared to the gold standard histopathological reports. It proves the better sensitivity and specificity of CT in evaluation of various sinonasal pathologies in symptomatic patients for the diagnosis, staging and thereby better planning of management. CT imaging can be considered as the best non-invasive modality of investigative choice for evaluating osteomeatal complex anatomy, variations and for assessing bony changes in various sinonasal diseases.

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